

## **Apple versus Android: Innovation in smartphone ecosystems**

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### Introduction

Advances in science and technology have created promising new opportunities for industries and economies to create value, which also have made them more complex as innovations can contain specialized knowledge from various disciplines. The chapter presents a general discussion pointing to the increased distribution of innovation activities in society due to digitalization and IT advances.

The purpose of this case is to explore how generativity relates to open innovation ecosystems. More specifically we address the question of how generative capacity attracts external actors to contribute with extensive value. The case sets out to explore the proposed shift in power relations among actors in such value ecosystems, and investigate the role of suppliers and complementors within distributed and innovation processes. To discuss these areas, we will draw on a comparative case study of two smartphone platforms – the *iPhone* and *Android*. The smartphone industry, as well as the two cases, was selected to highlight new forms of external involvement. The two cases have similarities but also differences in how they approach generativity.

### The Mobile Phone Industry in Change

The mobile phone industry is under rapid development. It has in recent decades moved from merely dealing with connecting voices to providing integrated services and add-ons, which have transformed the (mobile) telephone into a device capable of restructuring users' lives (e.g. Ling, 2004). Mobile communication and its fusion with the Internet has generated synchronization opportunities for email, calendar and notes, location-based services linked to online maps and GPS positioning, audio-visual services such as capturing and sharing digital photos, videos, and music, and other forms of leisure services such as games and online community applications (e.g. Lindgren *et al.*, 2002). This development has been enhanced by the availability of free toolkits for distributed application development (Bergvall-Kåreborn *et al.*, 2011).

A few studies have considered the mobile phone industry from an open innovation perspective. For instance, Dittrich and Duysters (2007) investigated how Nokia strategically

dealt with the changing technological environment in terms of exploration and exploitation in the years 1985–2002, and Lee *et al.* (2008) argued that mobile phone firms increasingly engage in exploitation-oriented alliances, standards, networks, and co-patenting.

Mobile technology is often described as consisting of several interrelated layers (e.g. Fransman, 2002; Zittrain, 2008) from infrastructural hardware to software applications. As such it includes developers of the technology platform, the operating system, the user interface, and applications, but also the network and service providers and mobile portal providers (e.g. Maitland *et al.*, 2002; Sabat, 2002). The various actors and roles constitute a wide association of relations and dependencies, which have increased in complexity as each layer has progressed. As mentioned earlier in the chapter, Zittrain (2008) among others has argued that the separation of these layers enhances the possibilities for new actors to enter the ecological system with fresh ideas.

One could argue that we are moving from a value-chain perspective toward what has been described as value ecosystems (Chesbrough and Appleyard, 2007). The concept of the value chain, popularized by Porter (1985), has been widely used to analyze how different actors are involved in creating value within the IT and mobile phone industry (e.g. Barnes, 2002; Maitland, *et al.*, 2002; Olla and Patel, 2002; Sabat, 2002). The idea behind the value chain is that products or offerings pass through a sequential chain of activities, each adding value to the process. Rülke *et al.* (2003) use a value-chain analysis to map the ecology of mobile commerce (m-commerce), involving the set of competencies, investments, and activities required to create and deliver value via the mobile phone. They argue that the m-commerce value chain has passed through three generations: the first was built around analog cellular voice services in the mid-1980s, the second generation was based on digital voice and data, and the third generation is based on the wireless Internet. As the industry matures, more elements have been added to the process, making it increasingly difficult for one single enterprise to provide competitive solutions to end users.

Peppard and Rylander (2006) propose that a value network would be a more appropriate metaphor than a value chain, since the old linear model does not accurately describe value creation in a digitalized economy. This is similar to the ideas of Freeman and Liedtka (1997) who introduced a stakeholder view as well as those of Kothandaraman and Wilson (2001) who suggested a value-nets view. Peppard and Rylander used Network Value Analysis (NVA) to analyze the evolution of the mobile services ecosystem, including defining and mapping the network's objectives, participants, value dimensions, and value linkages, concluding that mobile phone operators should emphasize a strategy of cooperation and partnering in service and content offerings. Also the proponents of a value-chain perspective discuss the problematic use of the chain metaphor representing value creation in the mobile phone industry. Maitland *et al.* (2002) agree in their analysis of the European mobile phone market that horizontal linkages or value nets and networks are important for understanding value creation. Olla and Patel (2002) choose the oxymoron “value chain network” to describe the telecom industry in the UK.

In sum, one could argue that the mobile phone industry has matured (Fransman, 2002; Maitland, *et al.*, 2002), shifting the value-adding focus from improving and adding technology

and design features to providing interactive smartphone services. Many of these services explore totally new territories, which makes it difficult to estimate their possibilities for success *ex ante* (Mathew *et al.*, 2004). When users to a large extent contribute to the generation and adoption of content, the growth and application of such smartphone services are much in the hands of large-scale end-user experimentation than to planned stage-gate implementations (Mylonopoulos and Sideris, 2006). Hence, there is a significant movement from “technology push” to “market pull,” influencing the more traditional mobile phone developers to add software features to their devices, but also attracting new actors to enter the market. This transition highlights the need to reflect on the evolving strategies for generativity, in terms of inducing openness in order to build a critical mass of content, engagement, and attention, but also using control to protect intellectual property rights and business models.

#### Case Description: the iPhone and Android

As a study into the shift in hegemony of the mobile phone industry in relation to generativity and external value creation, two mobile phone platforms will be introduced and analyzed: the iPhone and Android. The empirical material was collected through various public sources, such as news articles, official blogs, recorded public interviews, and press releases.

#### *iPhone*

The iPhone, launched by Apple on June 29, 2007, has been hugely successful in terms of sales of devices as well as software applications. When Apple’s CEO gave an introductory speech for the iPhone launch at the MacForum 2007, he started by saying:

*This is a day that I have been looking forward to for two and a half years. Every once and a while a revolutionary product comes along that changes everything. ... Apple has been very fortunate, it’s been able to introduce a few of these in the world. In 1984, we introduced the Macintosh. It didn’t just change Apple – it changed the whole computer industry. In 2001, we introduced the first iPod, and it didn’t just change the way we listen to music, it changed the entire music industry. Well, today we introduce three revolutionary products in this class. The first one is a widescreen iPod with touch controls. The second is a revolutionary mobile phone. And the third is a breakthrough Internet communications device. So three things... ... These are not three separate devices. This is one device, and we are calling it iPhone. Today, Apple is going to reinvent the phone. (Steve Jobs, MacForum 2007)*

The development of the iPhone was initiated in a joint project with Cingular, a wireless phone company now belonging to AT&T. However, Apple developed most of the iPhone’s hardware and software in-house, which led to the filing of more than 200 patents including for instance the multi-touch screen, scrolling, and zooming.

*We have invented a new technology called multi-touch which is phenomenal. It works like magic. You do not need a stylus, it is far more accurate than any touch display that has ever*

*been shipped. It ignores unintended touches, it is supersmart, you can do multi-finger gestures on it – and boy have we patented it!* (Steve Jobs, MacForum 2007)

Some of the hardware was also acquired as intellectual property from small state-of-the art high-tech firms. One such example is FingerWorks, founded by a doctoral student and a professor from the University of Delaware with a focus on multi-touch surface keyboards. Since its launch, the iPhone has been the subject of numerous lawsuits. In 2009, Nokia sued Apple for infringement of ten patents on various wireless technologies, which was followed by a countersuit against Nokia for infringement of 13 of Apples patents, such as display graphics, teleconferencing, and power conservation. The “war” between the different smartphone platforms (e.g. iPhone, Android, and Windows Mobile) has since then escalated. This has led to several more lawsuits and a high degree of competition over existing intellectual property rights, for instance between Apple and their biggest smartphone rival Samsung.

The operating system, iPhone OS, is based on a proprietary variant of the, in parts open-sourced, operating system Mac OS X Leopard. Also the Graphical User Interface (GUI) was developed in-house, and is considered a core value feature for the iPhone as it is designed for optimal user experience. For instance, the keyboard is integrated into the GUI based on the multi-touch functionality.

*We gonna start with a revolutionary user interface. It is a result of years of research and development and of course it is an interplay of hardware and software. ... [The other smartphones] all have these control buttons that are fixed in plastic and are the same for every application. Every application wants a slightly different user interface, a slightly optimized set of buttons just for it. And what if you think of a great idea six months from now, you can't run around and add a button to these things, they are already shipped.* (Steve Jobs, MacForum 2007)

The platform is designed to only run applications approved by Apple and identified with a cryptographic signature. On July 10th, 2008, Apple opened an online distribution channel named the *App Store*, where users of the iPhone and iPod Touch can browse and download applications directly to their devices, either free of charge or on average for a small cost. When it was launched the store contained 500 third-party applications, including 125 freeware programs. One year later it had over 55,000 available applications and there had been more than 1 million downloads in total. By October 2012, about 700,000 approved third-party applications had been added to the App Store. In early 2010, Apple also launched a tablet-like media device known as the iPad based on the same touch-based operating system as the iPhone.

### *Android*

The Open Handset Alliance (OHA) was established on November 5, 2007. OHA is a consortium of around 50 companies from the mobile phone industry including leading operators, handset manufacturers, semiconductor firms, software developers, and commercialization vendors, with

a shared goal of developing open standards for mobile devices. At the same time, Android was announced – a new, open-sourced, smartphone operating system.

*This alliance shares a common goal of fostering innovation on mobile devices and giving consumers a far better user experience than much of what is available on today's mobile platforms. By providing developers a new level of openness that enables them to work more collaboratively, Android will accelerate the pace at which new and compelling mobile services are made available to consumers.* (Press release, November 5, 2007)

Android was originally a small Palo Alto startup, acquired by Google in 2005 and later transferred to the Open Handset Alliance. Since the first release of the mobile phone operating system, several new updates have been launched. The Android initiative can be described as being open on three axes: toward the mobile phone industry (i.e. manufacturers, operators, vendors, etc.), toward users, and toward application suppliers. To support the mobile phone industry, the whole stack of codes for Android was released under an open-source license and runs on the Linux kernel. The members of the Open Handset Alliance agree upon shared technical standards for Android in order to enforce compatibility between hardware and software. At the same time, Android encourages the contributing actors to customize and differentiate the look-and-feel of the features they develop within these compatibility boundaries. Openness in relation to the users means that Android gives them increased freedom to control their experiences in terms of the applications installed and used. Most programs can be deleted or replaced and the system is designed so that user data can easily be ported to new applications. Regarding the openness toward application suppliers, Jason Chen, an Android developer from Google, stated:

*When we say Android is open for developers, it is a couple of important things. The first and foremost is that you as developers don't need to get permission to ship an application. There is no application certification for Android, and there is also no hidden or privileged APIs so there is no additional level of access or things that you have to do to get your device or application out on the market and to be able to take full advantage of the Android platform. ... The other way that Android is open to user developers is at a technical level. And the way we like to sum this up is really there are three key things ... and that is that you can integrate, extend, and replace existing components in the Android stack.* (Jason Chen, Android developer, Google, 2008)

The Android team developed tools for guiding application suppliers in emulating and debugging code in the Android framework. Android also initiated “challenges” in order to mobilize programmers to start generating applications for the system. The first challenge opened on January 3, 2008, and generated almost 1,800 new applications. On October 22, 2008, *Android Market* (later renamed Google Play) was made available to Android users as a distribution channel for browsing and downloading applications, similar to the iPhone App Store. The

application for the store was developed and managed by Google and is nowadays preinstalled on all Android handhelds. As of October 2012, there were approximately 700,000 official third-party applications available for Android, which equals the amount for iPhone. As with most of the Android features, Google Play is not an exclusive downloading tool. Any competitor can build their own “store” and suppliers can find other distribution channels to cater for end-users. For instance, in 2011 Amazon launched the Amazon Appstore to distribute apps on Android devices (and Apple sued Amazon for violating Apple’s trademark by using the term “appstore”).

In 2012, the analyst firm IDC released figures that Android had reached a 75% market share of smartphone sales during the third quarter, with 136 million sold units (compared to 26.9 million iPhone units). Much of this development is a result of the success of Samsung and its popular flagship phone Galaxy S.

## iPhone and Android

For both the iPhone and Android, involving external actors in innovation is an important driver for value creation across the innovation ecosystem. The comparative case study highlights two somewhat different approaches to distributed involvement, which will be discussed using Zittrain’s definition of generativity (Zittrain, 2008), as introduced earlier, in terms of leverage, adaptability, ease of mastery, accessibility, and transferability. The analysis is summarized in Table 1.

### *Leverage*

The generative capacity in terms of leverage means the extent to which the smartphone system acts as a lever for users and suppliers of applications to accomplish their goals. Both the iPhone and Android are aimed at the premium market segment, suggesting that they need to offer their users and application developers a solution with high potential leverage. With the iPhone, Apple has from the start focused on providing advanced built-in technologies and an operating system integrated with an intuitively designed phone, one which is also a general entertainment and utility device. For Android, several different handheld manufacturers work separately or jointly in advancing technological features adapted for the operating system. New models with different designs and performance are frequently released, pushing the development further. The technological infrastructure for both iPhone and Android handhelds is constructed so that it is easy for external suppliers to add new applications and take full advantage of the built-in features and sensors, such as the touch screen, GPS positioning, camera recorders, Wi-Fi, calibration tools, etc. The devices are built using separate layers easily reachable for external suppliers through common Application Programming Interfaces (APIs).

With standardized instructions and templates for application suppliers, the iPhone system has a unified look-and-feel, making externally developed applications familiar to users. Together with straightforward payment functions and distribution channels, the iPhone is attractive to external programmers, who have generated a huge number of applications. This critical mass of

applications makes the mobile device highly customizable for each user's specific needs, and the critical mass of users has created a lucrative market for application suppliers.

Android has fewer standards compared to the iPhone, creating a freer but also somewhat more chaotic environment for application developers. Android has put more emphasis on the generative aspects in that they allow for interaction and information exchange between the programs and databases locally installed on a mobile device. This allows application developers to build on other developers' work and ideas, which has increased the possibilities for a more complex user experience. Programmers can take advantage of features already installed, such as online maps, barcode scanners, and contact lists when designing new functions.

The ability to download applications after a device has been shipped clearly extends its leverage as a utility and entertainment device; each smartphone can be tailored to a user's unique needs and wants. By providing innovative applications for the iPhone or Android, companies can also leverage their offerings by integrating services with mobile technology and the ubiquitous presence. For instance, Facebook and Twitter have gained in value because users have access to their services wherever they are and can use a smartphone's built-in camera to publish online.

### *Adaptability*

Adaptability as a facet of generative capacity is the extent to which a mobile system can perform a variety of different tasks and how open it is for innovative and adaptive development. Android and the iPhone provide opportunities for the end user to install applications with a wide range of purposes, including games and entertainment, utilities, social networking, music, productivity, navigation, etc. With hundreds of thousands of applications and millions of active users, it is even possible to talk about "long tail" opportunities (Anderson, 2006) where niche programs of "non-hit items" can find a market. Apple has maintained a gatekeeping role over the iPhone and restricts the applications that are allowed to enter their App Store. The compulsory terms, which both guide and restrict a developer's creative work, are written down in the iPhone SDK (software development kit) Agreement. These include for instance prohibitions of pornographic and offensive content, abuse of Digital Rights Management, and the installation of executable code that can call other frameworks and APIs not approved by Apple. The principles provide clear directions to suppliers, with a low adaptability of the rules but a high adaptability within the rules. At the same time, it also imposes a risk of censorship to users and application suppliers if Apple decides that an application does not meet the required standard or poses a threat to Apple's idea of how the phone should function. A much debated case was when Google tried to launch an application called "Google Voice Apps" for the iPhone during the fall of 2009. What this program does is to provide extended services, such as voice mail with automatic transcription and call notification. The service can also replace the device's phone number with a "Google number," which offers low-cost international calls, free SMS, etc. The application, although highly appreciated by many users, was rejected by Apple due to the fact that it was said to emulate features that come with the actual phone and its predefined network provider.

With Android, negotiations of standards occur between all the Open Handset Alliance members, with Google as a main influential actor. The alliance partners participate in a

distributed innovation ecosystem where everyone can contribute to the development of the Android value ecosystem, pushing both hardware and software technology forward. Each handset manufacturer has to tailor new releases of the open-source operating system to their specific devices, and being involved early in the development process saves time and eases implementation. Google has taken a leading role in developing the operating system and for the release of Android 2.0 (also called Eclair) they worked closely with Motorola and Verizon in developing the phone Droid before the source code was revealed openly to the rest of the alliance partners. A couple of months later, Google launched (together with HTC) the Google branded handheld device Nexus One, which possibly complicated the alliance's balance of competition and collaboration a bit further. In August 2011, Google and Motorola Mobility announced that an agreement had been reached where Google acquired Motorola Mobility, but strongly pointed out that Android will still remain open.

There is the risk of forking (Lerner and Tirole, 2001) in open-source projects through the emergence of subgroups and multiple standards and software versions within the community. As Android provides a quite high degree of freedom and adaptability for any developer or developer group, the system can be applied also in business areas other than mobile phones, such as mini-PCs, computer tablets, televisions, and even automotive platforms. The whole project, due to its adaptability openness, faces huge coordination and compatibility challenges. From the user's perspective, however, the adaptability must be considered high in terms of the possibilities to tailor the smartphone exactly to one's needs. For common features, such as a browser, media player, and a phone book, preinstalled applications exist, but they can be to a large extent removed or replaced. New programs can be downloaded from various sources.

### *Ease of mastery*

Ease of mastery measures the degree of skill and knowledge needed to be able to understand and work with the functionalities of the mobile system. For users, ease of mastery is linked to user friendly and familiar design and commands, sensibility in the touch screen, clear instructions, easy account setup, few failures, breakdowns and interruptions, and a smooth and fast communication between hardware and software. For Android phones and in particular the iPhone, much effort has been expended in making it easy for users to master the devices, simplifying their experience through agile GUIs and state-of-the-art technology. The iPhone benefits in this sense because Apple has full control over the development processes for the hardware, the operating system and the GUI, supporting only one type of handheld device (although in several releases). Android, on the other hand, is integrated in a variety of different handheld devices, most of them with their own GUI implementation and some even with slight customizations of the Android stack. Hence, the user friendliness and design is to a large extent contingent on the work of each manufacturer.

The ease of mastery for users also involves the process of downloading applications and upgrading the system with new releases. Apple has control over the only distribution channel, App Store, which provides a smooth and easy way for users to install new content. Also Android phones have, with the preinstalled Google Play (previously called Android Market), a way of



searching and downloading applications similar to the App Store. The fact that the Android system does not block application developers from using other forms of program distribution allows alternative sources to emerge. This gives increased freedom to the actors in the ecosystem, but it might also lead to confusion for less advanced users when they have to navigate among many different distribution channels.

For external application providers, ease of mastery implies support for programming, testing, distributing, marketing, and charging for their applications. For both Android and the iPhone, toolkits and standard forms have been developed to guide and simplify programming tasks. Large communities support and give feedback in the process. Distribution channels such as the App Store and Google Play provide a cheap and effective means to connect supply with demand. Ease of mastery is further maintained by the iPhone because Apple has maintained overall control of the mobile platform and providers have one single contact when designing their services. Android suppliers have to take into consideration a number of different manufacturers and devices. On the other hand, their work is simplified by the fact that the operating system and APIs are freely revealed as open source.

### *Accessibility*

Accessibility as an aspect of generativity is the ease of access to the technology along with the tools and information to master it. A typical example of a technology with high accessibility is an ordinary PC, which comes in a wide range of prices, and can be opened and reconfigured without too much difficulty. For a user with the necessary skills it is relatively easy to start writing code for it. Transferring this concept to smartphones, accessibility can be divided into hardware and software accessibility. On the hardware level, the platforms compared are not easily accessible for users and developers. Whereas a PC can be modified with new drives, more memory, or extended with hardware connected via USB or FireWire, mobile phones have a limited set of possibilities to add or reconfigure hardware. Accessibility in terms of adding and developing software is different. Both systems are highly accessible for program suppliers with helpful tools and instructions, which makes it easy to both program and launch new applications at low cost.

For the iPhone, the programming language is Apple's Objective C, which limits the accessibility for new application suppliers who first need to learn that particular language. Apple supports suppliers with a free iPhone SDK, tools, frameworks, development best-practices, design methods, sample code, technical documentation, and guides for creating iPhone applications. Android offer similar resources for its suppliers but applies a more open and accessible system, with an SDK for Android and Android Development Tools (ADT) as a plug-in for the open-source development platform Eclipse, and the programming language is the well-known Java. Most of the system code is revealed as open source.

The iPhone is built around the idea that its content and experience should be accessible for end users. To secure this, Apple has limited certain aspects for application suppliers, such as the programming language, distribution channels, specific rules on design and content, etc. Due to Apple's rather strict policies and sometimes long lead times, suppliers risk not gaining access to

potential users when applying for acceptance of an application into the App Store, which is the sole source of downloads for users. Once accepted by Apple, however, applications are accessible to millions of iPhone users directly from their own handheld devices. The App Store provides a good overview of available applications to users and suppliers but the large number of applications in a single place can also generate an overload of information.

Apple being renowned for end-user accessibility, gained criticism when launching the iOS 6 operating system in the fall of 2012 with the application Maps as an integrated service. Apple removed the existing Google maps service that had been a part of the iPhone ecosystem from the beginning. iOS 6 Maps promised high resolution vector graphics maps, 3D modeled flyover views and voice-guided turn-by-turn navigation. However, a strong reaction soon grew among users against what was perceived as inaccessibility of the new Maps application. Feeds and blogs were mobilized for channeling images of low resolution map photos, misplaced landmarks and missing names. The events forced Apple CEO Tim Cook to apologize to customers for Maps in iOS 6 and suggest third party solutions – such as Bing, MapQuest and Waze – as replacements. Apple's strategy to control accessibility turned into a self-inflicted lock-in effect.

Android allows more freedom for the development of applications, but the lower restrictions could also be seen as increasing the risk of diluting quality and user friendliness. Android phones have Google Play as a preinstalled distribution channel, which works in a similar way to the App Store but has to date less content. Developers and users are also free to start their own channels for distributing applications. An even more elaborate way of tinkering with an Android phone is to “root” it. Rooting is a process where the user can become the superuser (root) of the phone and replace the operating system provided by the manufacturer in flash memory by a different version. New opportunities then emerge for the phone such as running a wider range of applications and performing hardware-related activities such as overclocking the processor. The freedom and “openness” of an Android platform provides high accessibility to users and suppliers with interest and knowledge in the technology, but the complexity of many parallel opportunities and channels can also reduce the feeling of accessibility for less skilled users.

### *Transferability*

Transferability measures how easily changes in the technology can be transferred to other users. A fully transferable technology means that adaptations made by skilled users can easily be conveyed to less-skilled users. For the iPhone and Android transferability is the extent to which the system is capable of transferring applications, improvements, and updates to other developers and users. Generativity in terms of transferability differs depending on the layer considered. For hardware development, the iPhone has rather low transferability since Apple does most of the work in-house. Android handheld manufacturers also mainly develop hardware internally, but have to raise standardization decisions with the Open Handset Alliance, which thereby opens up the matter for discussion and debate. The transferability for the operating system is considered high for Android, as it is based on Linux and open-source software. However, Google has, in the development of new versions of the operating system, worked closely with certain handheld

device manufacturers, giving them a head start. The iPhone's operating system is closed and it is not possible to transfer applications between users. For the iPhone as well as Android, new updates of the operating system are quite easily transferable to existing device owners.

Android has several ways of transferring applications, updates, and additions to applications. Although Google Play is the main channel for file transfer, peer-to-peer transfers are also possible between phones and applications can be downloaded to a computer and then copied and installed on a phone. Links with direct access to applications are published on the Internet, which can be used to download and install them on a phone. These features support transferability between both users and suppliers. The users of the iPhone must download all applications from the App Store, either via the built-in function in an iPhone or by using iTunes and transferring the application to the iPhone through USB. Direct sharing of applications between users is not allowed by Apple. To change an iPhone so that the App Store is no longer the sole distribution channel for applications and to be able to run unofficial code, some users have applied a method called "jailbreaking." Several alternatives are available, mostly providing free software, but paid applications also exist. Programs that have been rejected by the App Store can in this way find a market and, although not sanctioned by Apple, this strengthens the platform's transferability and thus at least one dimension of its generative capacity. Jailbreaking might not be considered illegal *per se* but it voids Apple's warranty on the device. It is, as mentioned before, also possible to open up Android phones through "rooting." From the perspective of generativity, however, jailbreaking is an act of transferability (since it allows the transfer of applications and updates between users) while rooting is a way to increase accessibility (since it allows users to manipulate the device on a deeper level). However, Android's open transferability and rooting and jailbreaking iPhones increase the risk of receiving a virus. For instance, in May 2011, a trojan virus called DroidDream was released on the Android Market in the form of free, pirated versions of existing priced apps. This allowed hackers to steal information from users. Governance structures, such as the iPhone's rather restricted App Store policies, protect users from potential malware and other risks caused by "unprotected" programs.

## Different Forms of Generative Ecosystems

Both the iPhone and Android are highly generative ecosystems. The main difference is the way that generativity in terms of the infrastructure is configured and governed. Apple has with the advent of the iPhone and App Store reshaped the smartphone market, bringing commercial and brand success in their effort to challenge developers, suppliers, and vendors of smartphones and mobile applications with a new technological platform. Apple clearly imposes a high level of control but also provides support to developers and it is easy to supply software and services to end users. Open Handset Alliance-based Android has chosen a similar but also to some extent different path with more open relations between hardware manufacturers, vendors, software

developers, and users, which calls for higher demands on compatibility between different stakeholders but is also open for new initiatives.

The choice of metaphor for the two distribution channels – “store” and “market” – are symbolic of the iPhone and Android in general. In a store, such as Bloomingdale’s or Walmart, sections and brands are placed within the ordered premises of the store. Designers and suppliers have the freedom to develop whatever products they want, but the store owner acts as the gatekeeper to what will be distributed through the store. This makes it possible to maintain quality and a consistent product range, which helps to build a strong unified store brand while at the same time allowing approved suppliers to nurture their own brands in a controlled manner. iPhone application developers have one effective channel for reaching potential customers, a quality check that their software meets the standard, and a ready-to-use e-commerce solution. On the downside, there is less flexibility and the risk of a slow cycle for approving new applications. Android Market/Google Play, on the other hand, can metaphorically be described as the digital equivalent to a souk in Marrakech or a bazaar in Dhaka. The market is characterized by less hierarchical structure and control over who is selling what, compared to a store. Each stand has thus more individual freedom, but receives also less support from the overall system in terms of logistical accessibility and user recognition. Android application developers do indeed have guidance in the form of an SDK, tools, frameworks, methods, and best practices and Google has taken a lead as provider of the preinstalled distribution channel, but in comparison to the iPhone, Android developers must rely more on their own capacity to brand their products and to reach users.

The two approaches described transform suppliers into peer producers. For the iPhone, the generative aspect of inviting external developers to participate in innovation is selective and concentrated at the later stages of the value chain (i.e. application development). For Android, generativity is a pervasive element throughout the whole platform (hardware, operating system, applications, etc.). In the management literature, suppliers are often portrayed as mere contractual deliverers of tasks agreed beforehand, within an overall project or value chain and bound by the customer’s carefully specified terms. The prevailing view of the relation between a firm and suppliers is that the firm is in control of the process and fully owns the outcomes. iPhone’s App Store and the Google Play provide arenas for peer production, where external developers creatively provide value to the communities of iPhone and Android users, respectively. As such, peer production promotes a new type of supplier and a new type of supplier relation. The generative aspects of the innovation process have strengthened suppliers’ as well as other stakeholders’ opportunities to boost value for themselves and for the whole value ecosystem.